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[0001] HOOK STYLE TAMPER EVIDENT LID

[0002] This application is a continuation-in-part of International Application No. PCT/CA03/00055, filed January 17, 2003, and also a continuation-in-part of International Application No.PCT/CA02/01311, filed on August 26,2002, and also claims the benefit of U. S. Provisional Application No. 60/399,731, filed August 1,2002.

[0003] FIELD OF THE INVENTION

[0004] This invention relates generally to injection moulded containers and their lids. More specifically this invention relates to tamper evident lids which may be applied to standard containers.

[0005] BACKGROUND OF THE INVENTION

[0006] Tamper evident (TE) features are very important in the packaging industry. Unfortunately, packages having tamper evident features generally require specific container and lid designs making the container and the lid a unique combination. A disadvantage to this type of design is that expensive moulds are required not only for the container but for the lid and the moulds are often limited in design to a single product.

[0007] Many applications in the food packaging industry currently use "standard" container sizes, which can be purchased from a multitude of suppliers. The containers are generally filled with packaging machinery adapted to those container sizes. If special containers and lids are to be used, it may be necessary to install additional machinery in a filling line to accommodate assembly limitations caused by the special tamper evident containers.

[0008] U. S. Patent No. 5,540, 342 by Rathbun describes a lid having a dual locking system to retain the lid on a container. The lid uses a plurality of primary beads and secondary locking ribs to retain the lid on the container.

[0009] However, one disadvantage of Rathbun's lid is that the locking ribs are completely removed from the lid once the lid is initially from the container, thus removing all visual evidence of the released locking ribs.

[0010] It is an object of the present invention to provide a tamper evident lid which may be used with a standard container. Preferably the lid may be mounted onto such a container using conventional packaging equipment currently available in most automated filling lines.

[0011] **SUMMARY OF THE INVENTION**

[0012] A tamper evident lid is provided for mounting over an opening of a container having sidewalls with a lip extending outwardly therefrom to define an opening. The lid has a base, a rim extending about the base for receiving the lip and at least one resiliently flexible finger extending radially inwardly from the rim for engaging the lip. Each finger has a length exceeding the distance between an inside of the lip and the sidewall and extends towards the base when the lid is mounted on the container. At least one frangible membrane is formed in the rim and associated with at least one of the fingers for facilitating tearing of the rim to disengage the associated finger(s) from the lip thereby enabling removal of the lid from the container while leaving evidence of removal by way of a torn frangible membrane.

[0013] The rim may have an upper end adjacent the base and a lower edge distal the base with the frangible membrane extending from the lower edge toward the upper end.

[0014] A respective of the frangible membranes may be disposed on opposite sides of at least one finger. Alternatively, at least one pair of fingers may be

provided with each one of the pair of fingers disposed on an opposite side of the frangible membrane.

[0015] The frangible membrane may extend to a membrane hinge formed in at least one of the rim and the base. The membrane hinge may be positioned to facilitate disengagement of the associated finger from the lip upon tearing of the frangible membrane.

[0016] The associated finger may be disposed between the membrane hinge and the lower edge.

[0017] The frangible membrane may extend to at least one membrane hinge formed in the rim. Each such membrane hinge may extend from the lower edge toward the base with an associated finger disposed in any area bordered by the frangible membrane, a membrane hinge and a lower edge.

[0018] A pair of fingers may be disposed between a pair of membrane hinges extending from the lower edge toward the base. A frangible membrane may extend from the lower edge to each one of the pair of the membrane hinges so that each of the fingers is disposed in an area bordered by at least part of the frangible membrane, one of the membrane hinges and the lower edge.

[0019] A pair of radially spaced apart frangible membranes may be provided with at least one of the resilient fingers disposed therebetween. A membrane hinge may extend across the base between the frangible membranes to facilitate disengagement of the fingers from the lip upon tearing of the frangible membranes by bending a portion of the base away from the lip.

[0020] A plurality of fingers may be disposed between the frangible membranes of the embodiment described in the preceding paragraph.

[0021] At least one of the fingers may be a webbed finger having a web defined by a reduced thickness region extending toward the rim from a lip engaging end of the webbed finger which is distal the rim.

[0022] Each webbed finger may be provided with a passage therethrough in the form of a window to promote drainage of fluid trapped between the webbed finger and the rim.

[0023] The fingers may be of various profiles including rounded, parallel faced straight, tapered narrowing toward the rim and tapered narrowing toward the rim with a scallop facing the container at an outer end thereof distal the rim.

[0024] Each finger may be curved in a direction generally corresponding to a curvature of the container to provide a lengthened contact zone with the lip.

[0025] The rim may be a recess extending from the fingers to the lower edge to accommodate the fingers thereby facilitating stripping of the lid in an injection moulding process.

[0026] The fingers may extend from the lower edge of the rim.

[0027] At least one pull tab may extend from the lower edge of the rim to facilitate tearing of at least one of the frangible membranes.

[0028] A stacking ring may extend about the base away from the rim to engage the lower edge of an adjacent tamper evident lid when the lids are stacked in order to resist lateral shifting therebetween. The stacking ring may be segmented or continuous.

[0029] A chamfer may extend into the rim from the lower edge at the juncture of the frangible membranes and the lower edge to avoid a sharp corner at the juncture upon tearing of the frangible membrane.

[0030] **BRIEF DESCRIPTION OF THE DRAWINGS**

[0031] Preferred embodiments of the present invention are described below with reference to the accompanying illustrations in which:

[0032] Figure 1 is a perspective view from below of a tamper evident lid according to the present invention;

[0033] Figure 2 is a perspective view from above of the lid of Figure 1;

[0034] Figure 3A is a perspective sectional view taken at line 3-3 of Figure 1;

- [0035] Figure 3B is a view corresponding to Figure 3A but taken from the inside rather than from the outside of the lid ;
- [0036] Figure 4 is a perspective sectional view taken on line 4-4 of Figure 1;
- [0037] Figure 5 is an axial section of an outer portion of a lid according to the present invention illustrating how it mounts over a container;
- [0038] Figure 6 is an axial sectional view of a lid according to the present invention being moulded and illustrating the associated mould components;
- [0039] Figure 7 is a schematic view of an injection moulding arrangement for forming a lid according to the present invention;
- [0040] Figure 8 is a perspective view from below illustrating an alternate embodiment for a temper evident lid according to the present invention;
- [0041] Figures 8a and 8b are scrap perspective views illustrating alternate features associated with the Figure 8 embodiment;
- [0042] Figure 9 is a sectional perspective view illustrating a further alternate embodiment for a tamper evident lid according to the present invention;
- [0043] Figure 10a is a perspective view from above illustrating a still further embodiment for a tamper evident lid according to the present invention;
- [0044] Figure 10b is a perspective from below of the Figure 10a embodiment;
- [0045] Figures 11 and 11a illustrate alternate embodiments for a "finger" portion illustrating a tamper evident lid according to the present invention;
- [0046] Figures 12 and 12a are respectively scrap perspective views from below and above illustrating a "pull tab" feature of a tamper evident lid according to the present invention;
- [0047] Figures 13a, 13b, 13c and 13d are scrap perspective views illustrating further alternate embodiments for a "finger" portion of a tamper evident lid according to the present invention;
- [0048] Figure 14 is a scrap perspective view illustrating a still further alternate embodiment for a "finger" portion of a tamper evident lid according to the present invention;

- [0049] Figure 15 is a scrap perspective view illustrating an embodiment of a tamper evident lid according to the present invention wherein a "finger" portion extends from a lower edge thereof;
- [0050] Figure 16 is a perspective view from above illustrating yet another alternate embodiment for a tamper evident lid according to the present invention;
- [0051] Figure 17 is a perspective view from above illustrating the use of chamfered edges as a safety feature associated with "tab" portions of a tamper evident lid according to the present invention;
- [0052] Figure 18 is a perspective bottom view of a further embodiment of the lid of Figure 1;
- [0053] Figure 19 is an enlarged view of an operated tab portion of the lid of Figure 18;
- [0054] Figure 20 is a side sectional view taken on the line 5-5 of Figure 18;
- [0055] Figure 21 is a perspective bottom view of an alternative embodiment of the lid of Figure 18;
- [0056] Figure 22 is a side sectional view taken on line 6-6 of Figure 21; and
- [0057] Figure 23 is a top view of an alternative embodiment of the lid of Figure 18.

- [0058] DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS
- [0059] A tamper evident lid ("lid") according to the present invention is generally illustrated by reference 10 in the accompanying illustrations. The lid 10 has a base 12 and a rim 14 which extends about the perimeter of the base 12.
- [0060] Discrete fingers 20 extend from an inside of the rim 14. The fingers extend radially inwardly and toward the base 12 (inwardly and upwardly as illustrated in the figures).
- [0061] The lid 10 is intended for mounting over a "standard container" 13 as illustrated in Figure 5. A portion of a sidewall of such a container 13 is shown in dashed lines at reference 30. As typical with such containers 13 which are

commonly used for food and other applications, the sidewall 30 terminates in an outwardly and downwardly extending lip 32. The lip 32 defines an opening 34 over which the lid 10 may be mounted.

[0062] Each of the fingers 20 has a length which exceeds the distance or "gap" between the inside of the rim 14 and the outside of the sidewall 30 as illustrated at reference 41. The length of the fingers 20 exceeds the breadth of the gap as illustrated by arrow 44. Accordingly, when the lid 10 is forced over the lip 32, the fingers 20 flex toward a retracted position against the inside of the rim 14. Once fully past the lip 32, the fingers flex inwardly, away from the rim 14, to rest against the sidewall 30. The direction of this spring bias is indicated by reference 31. In order to enable the flexing of the fingers 20, the material of the lid 10 must have a desired degree of resiliency which is characteristic of the type of plastics typically used for such lids (polyethylene for example). Basically the fingers 20 must be able to flex without breaking off.

[0063] Once in place, removal of the lid 10 from the container 13 is resisted by the fingers 20 engaging an underside 36 of the lip 32. As the ends of fingers 20 rest against the sidewall 30, the fingers 20 can rely on the sidewall 30 for support and accordingly a tremendous amount of strength is not required from the fingers 20. This proves advantageous in stripping the lid 20 from an injection moulding assembly, as discussed below.

[0064] To either side of the fingers 20 is a frangible membrane 22 (see Fig. 1) formed in the rim 14 to define "tear tabs" 24. The tear tabs 24 may be pried away from the sidewall 30 by tearing the frangible membranes 22 to either side to move the fingers 20 out of engagement and away from the lip 32. This enables removal of the lid 10 from the container 13 but only by leaving evidence in the form of torn frangible membranes 22.

[0065] A membrane hinge 26 (see Fig. 3a) may be provided at the top of the tear tabs 24 to maintain the tear tabs 24 affixed to the remainder of the lid 10 after tearing of the frangible membranes 22. This avoids having to tear the tear tabs 24

out entirely in order for the fingers 20 to be disengaged from the lip 32. Without the hinge 26, the resiliency of the lid 10 might otherwise keep urging the fingers 20 into engagement with the lip 32 even with the frangible membranes 22 torn.

[0066] Alternatively the membrane hinge 26 may be substituted for a further frangible membrane 22 to allow complete removal of the tear tabs 24.

[0067] An inwardly extending rib 50 (see Fig. 1) may be provided about the rim 14 of the lid 10 between the break tabs 24. The ribs 50 serve to further secure the lid 10 over the opening 34 by engagement with the lip 32 (see Fig 5).

[0068] Preferably the rim 14 at the tear tabs 24 is thinner below the finger 20 (distal the base 12) than above the finger 20 (proximal the base 12) by an amount corresponding to the thickness of the fingers 20. This forms a recess 28 (see Fig 3b) which accommodates the fingers 20 during a stripping stage of the lid 10 in an injection moulding operation.

[0069] Figures 6 and 7 illustrate a mould assembly for plastic injection moulding of the lid 10. The mould assembly includes a cavity 100 which receives a two-part mould core made up of a removing core poppet 102 and a core base 104. A stripper ring 110 extends about the core base 104 to engage a lower edge 18 of the rim 14 of the lid 10. The cavity 100 and moving core poppet 102 are movable in opposite relative directions as are the core base 104 and moving core poppet 102.

[0070] After injection and solidification of a molten resin to form the lid 10, the formed lid 10 will typically shrink onto the moving core poppet 102 and core base 104 enabling the lid 10 in combination with the core poppet 102 and core base 104 and stripper ring 110 to be moved away from the cavity 100 as the mould is opened. Next, the core poppet 102, stripper ring 110 and lid 10 move away from the core base 104 toward the cavity 100. The core poppet 102 stops moving and the stripper ring 110 pushes the lid 10 off of the poppet 102.

[0071] As shown by dashed lines in Figure 6, the finger 20 flexes away from the base 12 of the lid 10 and is accommodated by the recess 28 as the lid 10 is lifted off of the moving core poppet 102.

[0072] The fingers 20 will generally retain enough "memory" to resiliently flex toward their original position as the formed lid 10 cools after stripping.

[0073] Alternatively the fingers 20 may be configured to cool so as to point away from the base 12 ("down") and be pushed into an "upwards" position mechanically after moulding.

[0074] Although six tear tabs 24 are illustrated, other numbers are possible. Generally it is expected that six to eight will prove an optimal compromise between security and effort to remove the lid 10. It may be possible to have as few as one tear tab 24 if it is broad enough to retain the lid 10 on the container 13. Two or more is preferable. It is generally not necessary to lift away all of the tear tabs 24 for removal of the lid 10. Lifting away the tear tabs 24 about half the perimeter and sometimes less of the lid 10 will generally prove sufficient to enable removal of the lid 10 when installed on the container 13.

[0075] As illustrated in Figure 8 it isn't necessary to provide a frangible membrane 22 on opposite sides of the fingers 20. For example, more than one finger 20 may be provided between adjacent of the frangible membranes 22. Alternatively, as illustrated in Figure 8a, a single frangible membrane 22 may be provided adjacent the finger 20. Whether the latter arrangement is truly effective will depend on the overall configuration of the lid 10 and how many fingers 20 have to be displaced in order to release the lid 10. This arrangement may be less practical when several fingers 20 are used unless the frangible membrane 22 extends from a lower edge 29 (see Figure 11) of the rim 14 about the finger 20 to a membrane hinge 26 on an opposite side of the finger 20 as illustrated in Figure 8b.

[0076] In some instances it may be desirable to avoid the use of a membrane hinge 26 or to provide one with significant restorative force characteristics. This might for example be the case where it is desired for the fingers 20 to participate in "locking" the lid 10 to the container lip 32 upon reapplication of the lid 10. Such an arrangement is illustrated in Figure 9.

[0077] As illustrated in Figures 10a and 10b, the membrane hinge 26 may extend across the base 12 between two frangible membranes 22. This provides good opening characteristics and is particularly useful for spices and other pourable products.

[0078] Figures 11 and 11a illustrate fingers 20 of considerably more span than in many of the other illustrations. In order to achieve such a span without interfering with flexing of the fingers 20 toward the base 12 and to maintain engagement between a lip engaging end 21 of the fingers 20 distal the rim 14, webs 23 are provided. The webs 23 represent a thinner area (i. e. a reduced thickness region) extending toward the rim 14 from the lip engaging end 21. The webs 23 enable the finger 20 to flex in a manner similar to a row of closely spaced individual fingers 20 of lesser span in side by side juxtaposition.

[0079] The wider span fingers 20 of the Figures 11 and 11a embodiment may be more prone to retaining moisture between the fingers 20 and the rim 12. Accordingly passages or holes in the form of windows 25 may be provided through the fingers 20 as shown in Figure 11a. The windows 25 are illustrated as being rectangular however any configuration may be used including circular and triangular and combinations of the foregoing.

[0080] As illustrated in Figures 12 and 12a, one or more pull tabs 40 may be provided extending from the rim 14 of the lid 10 away from the base 12. The pull tabs 40 assist in tearing of the frangible membranes 22 by providing an enhanced gripping surface for digital grasping. Preferably the pull tabs 40 should bend radially outwardly somewhat to assist in stacking of the lids 10.

[0081] A variety of configurations for the fingers 20 may be utilized. Figures 13a through 13d illustrated a few representative examples. Figures 13a illustrates a rounded configuration. Figures 13b illustrates a straight parallel faced configuration. Figure 13c illustrates a tapered configuration narrowing toward the rim 14. Figure 13d illustrates a configuration similar to that of Figure 13c but

further having a scallop 42 for facing the container extending into its lip engaging end 21.

[0082] Figure 14 illustrates a finger 20 which is curved facing the container in a direction generally corresponding to a curvature of the container. This provides a longer contact zone along the lip engaging end 21 than would be possible with a straight finger 20. A straight finger 20 would have a tendency of only engaging the lip 22 along part of the length of the lip engaging end 21.

[0083] Figure 15 illustrates a portion of a rim 14 having a finger 20 extending from its lower edge 29 thereby eliminating a "foot" portion 44 of the rim 14 which extends between the lower edge 29 and the finger 20 in the other illustrations. Such an arrangement is possible but wouldn't stack as well as the lids 10 having a foot portion 44 and would therefore apply more to large industrial containers than stackable filling lines.

[0084] Referring to Fig. 16, to promote stacking a stacking ring 46 may be provided extending about the base 12 in a direction opposite to that of the rim 14. The stacking ring 46 engages the foot portion 44 of an underlying lid 10 to resist lateral shifting therebetween. The stacking ring 46 may be segmented as illustrated in Figure 2 or continuous as illustrated in Figure 16.

[0085] A continuous stacking ring 46 can be easier to manufacture. To provide a continuous stacking ring 46 the membrane hinge 26 may be located on the rim 14 below the base 12. Figure 16 shows two possible arrangements. In the first such arrangement the membrane hinge 26 is to the right of a tab 24 and a frangible membrane 22 extends from the lower edge 29 about the finger (not illustrated) to the frangible membrane 26. The finger would extend radially inwardly from the tab 24.

[0086] Alternatively, as shown toward the right of Figure 16, the tab 24 may be defined by a membrane hinge 26 between the lower edge 29 and the base 12 and a frangible membrane 22 to either side thereof. The frangible membranes 22 extend from the lower edge 29 to the membrane hinge 26.

[0087] As a safety precaution it is desirable to avoid sharp edges upon tearing of the frangible membranes 22. One way of achieving this, as illustrated in Figure 17, is to provide a chamfer 52 extending into the rim 14 from its lower edge 29 at the juncture of the frangible membrane 22 and the lower edge 29. The chamfer will avoid a sharp point in the torn frangible membrane 22. Different arrangements of the membrane hinge 26 and the frangible membranes 22 are illustrated in Figure 17 in association with the chamfer 52.

[0088] Referring to Figure 18, an alternative embodiment of the lid 10 has the rim 14 extending around the periphery of the base 12 and depending from the base 12 to the lower edge 29. A series of the tabs 24 are located at spaced locations around the rim 14 for indicating the sealing state of the lid 10 when mounted on the container 13 (see Figure 5), i. e. either previously opened or unopened. The tabs 24 have adjacent frangible membranes 22, situated adjacent to each of the fingers 20, between a main sidewall 25 of the rim 14 and the tabs 24. The frangible membranes 22 extend between the lower edge 29 of the rim 14 and the base 12. The inwardly extending ribs or undercuts 50 have extending portions 60 that extend past the membranes 22 and overlap onto the underside of the tabs 24, while leaving sufficient spacing for the fingers 20 as an interrupted portion 62 between adjacent ones of the extending portions 60. The interrupted portions 62 allow the fingers 20 to flex outwardly towards the retracted position against the inside of the rim 14. It is noted that the tabs 24 have a first tab portion 24a including the overlapped extending portions 60, and a second tab portion 24b positioned between the first tab portion 24a and the lower edge 29 of the rim 14. Further, the lid 10 can also have vertical ribs 74 positioned on the first tab portion 24a to help alleviate bounce on the spin bars (not shown) during manufacture of the lid 10.

[0089] Referring to Figure 19, in operation of the lid 10, the extending portions 60 interrupt the tearing of the frangible membranes 22, such that the second tab portion 24b separates from the main sidewall 25 of the rim 14, while the first tab portion 24a remains attached thereto. The extending portions 60 of the rib

50 provide tear resistance of the membranes 22, such that only part of the membranes 22 tears adjacent to the second tab portion 24b. This partial tearing of the membrane 22 helps to maintain the integrity of the rim 14 between the ribs 50 and the base 12, such that the lid 10 once opened can be resealed onto the container 13 (see Figure 5).

[0090] Referring to Figure 20, it can be seen that the first tab portion 24a is thinner in cross section than that of the second tab portion 24b, thereby defining an offset sidewall that provides an offset hinge 64. It is recognised that positioning of the offset hinge 64 between the portions 24a and 24b helps to promote bending of the tab portion 24b to one side of the extending portions 60, providing a means for the finger 20 of the tab portion 24b to remain positioned away (see ghosted view) from the sidewall 30 of the container 13 (see Figure 5) once the membranes 22 are partially broken during opening of the lid 10. Further, it can be seen that a local pocket 66 is provided by the first tab portion 24a between adjacent sections of the sidewall 25 (see Figure 19).

[0091] Referring to Figures 6 and 20, it is recognised that forming the frangible membranes 22 from the lower edge 29 to the base 12 helps to provide for moulding efficiencies, such as but not limited to reducing the need for slider mould mechanisms (as is known in the art) as compared to forming piecewise membranes 22 (see Figures 16 and 17) partway in the rim 14, which extend from the lower edge 29 to approximately midway to the hinge 26. Further, it is recognised that the offset sidewall of the tab 24 can help to position ejection forces of the moulding process away from the ribs 50.

[0092] Referring to Figure 21, an alternative embodiment of the lid 10 is shown having both the offset tab 24 and an offset sidewall 25, which consists of a first sidewall portion 25a and a second offset sidewall portion 25b. Provision of the adjacent tab portions 24a, b and sidewall portions 25a, b gives a continuous offset around the rim 14. For example, the outside surfaces of the tab portions 24a, b and

the respective sidewall portions 25a, b can be flush with one another on either side of the intervening membrane 22.

[0093] Referring to Figure 22, it is noted that the inside wall of the rim 14 has an inset region 68 located between the tab portions 24a, b to help maintain consistency of the thickness of the rim 14. A tapered transition portion 70 positioned to either side of the tab 24 helps to locally stiffen the connection between the tab portions 24a, b (i.e. offset hinge 64) to help maintain the structural integrity of the lid 10 when installed on the container 13 (see Figure 5), as well as to help transfer ejection forces from the lower edge 29 to eject over the rib 50 and rib extending portions 60. The lid 10 also has an angled abutment member 72 located adjacent to the lower edge 29 and oriented radially inwards from the inside surface of the rim 14. The angled abutment member 72 increases the thickness of the rim 14 near the lower edge 29, thereby helping to increase a tendency for toe-in of the lower edge 29 (warping of the lower edge 29 radially inwards) during cooling of the lid 10 in the moulding process. Further, the abutment member 72 can also enhance stackability of the lid 10 by providing a thicker lower edge 29 for placement on the base 12 of an adjacent lid 10 (not shown), outwardly of the stacking ring 46.

[0100] Accordingly, the lid 10 of Figures 18 to 22 includes an offset tab 24 (and optional offset sidewall 25) configuration for providing an offset hinge 64 at the point of offset. The extending portions 60 overlap the first tab portions 24a to interrupt the rupture of the frangible membranes 22, such that the membrane 22 tearing is inhibited from damaging the integrity of the rim 14 between the ribs 50 and the base 12. The thickness of the ribs 50 and corresponding extending portions 60 are sufficient to resist tear continuation of the membrane 22 past the ribs 50, and therefore restrict or otherwise localise separation of the tabs 24 from the sidewall 25 primarily to the second tab portions 24b. Maintaining integrity of the rim 14 near the base 12 helps to provide a resealing capability to the lid 10 once opened.

[0101] Referring to Figure 23, an alternative embodiment of lid 10 is shown in a rectangular (or square) configuration. The lid 10 can also have vertical ribs 74 positioned on the first tab portion 24a.

[0102] The above description is intended in an illustrative rather than a restrictive sense. Variations may be apparent to those skilled in the relevant art without departing from the spirit and scope of the invention as defined by the claims set out below.